rous as the stars, flew in all possible directions, except from the earth, toward which they all inclined more or less; and some of them descended perpendicularly over the vessel we were in, so that I was in constant expectation of their falling among us. My thermometer which had been at 86° of Farenheits scale for four days, fell to 56° about 4 o'clock A. M. and nearly at the same time the wind shifted from the South to the N. W. from whence it blew with great violence for three days without intermission. We were in latitude 25° N. and S. E. from Kay Largo, near the edge of the Gulph Stream."

I have since been informed that the above phenomenon extended over a large portion of the West India islands and as far North as Mary's in latitude 30° 42′ where it appeared as brilliant as with us off Cape Florida.

No. VI.

Improved method of projecting and measuring plane Angles by Mr. Robert Patterson communicated by Mr. Andrew Ellicott.

Read 6th March, 1801.

SIR,

THE laying down, and measuring of plane angles, constitute so great a part of practical geometry, that any attempt to render this operation more easy and acurate than by the line of chords, or any other method now in common use, will not, I presume, be deemed altogether unimportant.

The lines of chords on our common scales are in general very inaccurately divided, and even if we suppose the divisions ever so exact it will still be impracticable to take off the measure of an angle to greater accuracy then a half or third of a degree at most; as it is impossible to apply either the nonius or diagonal method of subdivision to a line of unequal parts.

But in the method that I am about to propose a line of equal parts only is used, and therefore the divisions and subdivisions may, by either of the above modes, be made as minute and accurate as can be desired.

The radius of a circle of which the chord of any given arch shall contain just as many equal parts of the radius as the arch contains degrees, is easily calculated. The one I have chosen is that of a circle of which the chord of an arch of 25 degrees shall equal 25 parts. This radius is $57\frac{3}{4}$ very nearly. Now it will be found that of this circle the chord of any arch under 30 degrees will never vary more than $\frac{1}{12}$ part of a unit from the number of degrees in that arch.

Hence to lay down an angle of any given number of degrees and parts you have only to take, with a pair of compasses, from any line of equal parts, $57\frac{3}{4}$, and with this radius describing an arch, apply thereon, from the same line, the chord of the angles required, if not exceeding 30 degrees; (calling each part or equal division of the line a degree) and the two radii drawn from the center to the points of application on the arch, will contain the angle required. If the given angle exceeds 30 degrees, first apply the radius (which equals the chord of 60 degrees) and then taking from the line of equal parts the chord of the difference between 60 degrees and the given angle, apply it on the arch from 60 either forwards or backwards according as the given angle is greater or less than 60 degrees.

The measuring of an angle being only the reverse of the former will consist in describing an arch round the angular point as a center with a radius equal $57\frac{3}{4}$, and then applying the chord of this arch comprehended between the two lines including the angle, if not exceeding 30 degrees, to the same line of equal parts from which the radius was taken. But if the angle exceeds 30 degrees you must first apply the radius, and then measure the arch of excess or defect above or below 60 as above.

Though the above method of projecting and measuring angles will never be liable to an error of more than five or six minutes of a degree, which in practice may be safely neglected, yet even these small errors may, when thought necessary, be allowed for as follows—

$$\left.\begin{array}{l}\text{From 6 degrees to 21}\\ \text{From 28———to 30}\end{array}\right\}\text{call the angle 5 minutes}\left\{\begin{array}{c}\text{more}\\ \text{less}\end{array}\right\}$$

than it measures and if this allowance be made the error will scarce ever exceed one minute.

The diagonal scale of 20 parts to an inch will be of a very convenient size for the above purpose—On this the half inch is divided into 100 equal parts, each of which will correspond to 6 minutes.

But this method of subdividing lines of equal parts, though no doubt susceptible of great accuracy, is yet attended with inconveniencies which it would be desirable to obviate—such lines occupy so much room on the scale, that but few of them can be inserted, and among such a multiplicity of crossing lines, the eye is liable to mistake one for another.

The following method which is only an application of the nonius division, is susceptible of even greater accuracy and minuteness than the diagonal method, and yet free from all its inconveniencies.—Let each of the larger divisions of the line be subdivided into 10 equal parts, as the line of inches on the common scale; then if you would farther subdivide these, say each into 10 equal parts, you must set off before the beginning of the line, a space equal to 11 of the smaller divisions, which divide into 10 equal parts, numbering them backwards 1, 2, 3, &c. and then each of these divisions on the nonius will exceed one of the smaller divisions on the scale just $\frac{1}{10}$ part of the latter.

The manner of using this nonius in laying down or measuring lines is sufficiently obvious—Thus if you would take off with a pair of compasses $27\frac{6}{10}$ you must extend from 6 on the nonius to 21 (27-6) on the scale, if you would take off 57 $\frac{7}{10}$ extend from 7 on the nonius to 50 on the scale &c. But a still more minute subdivision may be easily made by combining the nonius and diagonal methods together—thus if each of the lesser divisions, both on the scale and nonius were, by diagonals, subdivided into 10 equal parts, then each of the larger divisions would in fact be subdivided into 1000 equal parts, and yet none of the lines, even on the scale of 20 to an inch, would be less than $\frac{1}{20}$ of an inch assunder. Such a degree of minuteness can however seldom if ever be necessary, and therefore the use of the diagonal scale may be entirely dispensed with.

In Plate III. Fig. 7. the nonius occupies a space equal to 13 of the smaller divisions on the scale, and is divided into 12

equal parts; and therefore, if this line be used as a line of chords, the nonius will divide the degree into 12 parts or 5 minutes.

I am, with sincere respect,

your obliged friend

R. PATTERSON.

ANDREW ELLICOTT Esq.

No. VII.

Sur La Théorie des Vents. Par M. Dupont de Nemours.

Read July 17, 1801.

Le Vent a trois causes: la *dilatation* de l'air par la chaleur, qui le chasse de l'endroit où cette chaleur est éprouvée: la *Condensation* de l'air par le froid, qui le rappelle vers le lieu où le refroidissement se fait sentir; et la *revulsion* qui, lorsqu'un courant d'air s'est établi par une des deux causes précédentes, attire des parties environnantes une nouvelle colonne d'air à la place de celle qui a été mise en mouvement.

La rotation diurne de la terre produit toujours une *dilatation* de l'air, qui est successive dans tous les points du Glôbe où le soleil paroît se lever et où il passe jusqu'à son midi: dilatation que l'echauffement des terres entretient plus ou moins longtemps au delà de midi, selon la nature de ces terres. Et cette dilatation est toujours suivie d'une *condensation* que le soir et la nuit ramènent en chaque lieu jusqu'à la renaissance du nouveau jour.

C'est ce qui produit le Vent *d'Est* général, qui est plus sensible dans la Zône où la chaleur est plus développée.

La ligne de la plus grande chaleur se maintient depuis deux jusqu'à quatre degrés de latitude au nord de celle que trace le cours du soleil, en passant d'un Tropique à l'autre et sur l'Equateur, parceque le Pôle et l'Hémisphere austral, entourés de Mers, ne sont pas si susceptibles d'échauffement que l'hémisphere boréal où il y a moins de mer que de terre.